CYLINDER ASSEMBLY FOR HERMETIC COMPRESSOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is generally related to a compressor and more specifically, to a cylinder assembly for a hermetic compressor.

2. Description of the Prior Art

Generally, a cylinder assembly, as shown in FIGs. 1 and 3, includes a hermetic casing 100 wherein a drive unit 200 and a compression unit 300 are formed.

The hermetic casing 100 includes an upper casing 110 and a lower casing 120, and an inlet tube 130 is formed in the hermetic casing 100. Lubricating oil is contained at the bottom of the lower casing 100.

The drive unit 200 includes a stator 210 fixed inside the hermetic casing 100, a rotor 220 which spins inside the stator 210, and also a crank shaft 230 integrally formed with the rotor 220 to spin

along with the rotor 220.

The compression unit 300 consists of a connecting rod 310 that is connected to an eccentric portion 240 of the crank shaft 230 and that converts circular movement of the rotor 220 into backward and forward linear movement of a piston 320, which is connected to one end of the connecting rod 310. A cylinder assembly 400 accepts and guides the reciprocating motion of the piston 320.

The cylinder assembly 400 includes a cylinder block 420 having a cylinder 410, a cylinder head 430 which is connected to the cylinder block 420 to seal the cylinder 410, and a valve assembly 440 disposed together with gaskets 480, 490 between the cylinder block 420 and the cylinder head 430.

As shown in Fig. 1-3, the inside of the cylinder head 430 is divided by a partition 431 into a suction chamber 432 and a discharge chamber 433. Formed at a side of the cylinder head 430 is an inlet hole 434 (Fig. 2) to connect a suction muffler 500 and a suction chamber 432.

The cylinder block 420 has a discharge muffler 421 to reduce noise generated by compressed refrigerant flow. The discharge muffler

421 is connected to the discharge chamber 433 of the cylinder head 430 through an outlet path 422 which is formed in one side of the cylinder block 420.

The valve assembly 440 includes a valve plate 450, a suction valve 460 and a discharge valve 470.

The valve plate 450 has a suction port 451 and a discharge port 452. The cylinder 410 of the cylinder block 420 and the suction chamber 432 of the cylinder head 430 are in fluid communication via the suction port 451. Moreover, so are the cylinder 410 of the cylinder block 420 and the discharge chamber 433 of the cylinder head 430 via the discharge port 452.

The suction valve 460 is positioned near the cylinder block 420 of the valve plate 450 in order to selectively open the suction port 451. The suction valve 460 is formed by cutting out a part of the suction valve sheet 461 disposed between the cylinder block 420 and the valve plate 450. The discharge valve 470 is located nearby the cylinder head 430 of the valve plate 450 in order to selectively open the discharge port 452. Formed at the back of the discharge valve 470 by turns are a

stopper 471 and a keeper 472 to control lift of the discharge valve 470. The suction valve 460 and the discharge valve 470 move freely according to pressure in the cylinder 410, opening and closing the suction port 451 and the discharge port 452, which makes it possible for refrigerant of the suction chamber 432 to flow into the cylinder 410 and for refrigerant of the cylinder 410 to be discharged into the discharge chamber 433. Specific explanation of prior cylinder assembly 400 follows with reference to FIG. 3.

When the piston 320 moves from an upper end of its travel to a long end of its travel, a negative pressure in the cylinder 410 makes the suction valve 460 move freely as shown in one dotted line of FIG. 3 to open the suction port 451, causing the refrigerant to be drawn into the cylinder 410 through the suction port 451.

Then, the piston 320 compresses the refrigerant in the cylinder 410 by moving from the lower end of its travel toward the upper end of its travel, and accordingly, the pressure of the cylinder 410 increases. As a result, the suction valve 460 is moved to close the suction port 451, as shown in solid line of FIG. 3, by the high pressure in the cylinder

410.

Then, the piston 320 moves further towards its upper end of front dead end, and the pressure of the cylinder 410 more increases. When the piston 320 gets to the upper dead end of travel, the pressure inside the cylinder 410 is at its maximum. At this time, the cylinder pressure has the discharge valve 470 move as shown in solid line in FIG. 3, thereby opening the discharge port 452. Therefore, the compressed refrigerant in the cylinder 410 is discharged into the discharge chamber 433 of the cylinder head 430 through the discharge port 452.

Meanwhile, the piston 320 having reached the upper end of its travel, moves towards the lower end of its travel. During this movement, the discharge valve 470 moves (owing to recovery force) as shown in solid line in FIG. 3, to close the discharge port 452 and the suction valve 460 opens the suction port 451 again as the negative pressure is generated in the cylinder 410.

However, when the discharge valve 470 of the prior art cylinder assembly 400 opens and closes the discharge port 452, the recovery

force from a neck portion 470a of the discharge valve 470 and from a bending portion 471a of the stopper 471 cause the discharge valve 470 to be closed by striking the valve plate 450. Energy generated as the valve plate 450 is hit produces a noise-causing sound wave that is a problem of the conventional compressor: noise is produced when the compressor is operated.

Moreover, the conventional cylinder assembly 400 has another drawback: high manufacturing cost due to the big size of the valve plate 450 and the suction sheet 461, and the complex structure of the valve assembly 440.

SUMMARY OF THE INVENTION

The present invention overcomes these problems of the prior art. The main object of the invention is to provides a quieter hermetic compressor. This is achieved by applying a sound transmission loss theory, so that the sound wave generated when a discharge valve strikes a valve plate is discharged through two separate discharge chambers in a cylinder head to a discharge muffler.

Another object of the present invention is to provide a cost-

effective cylinder assembly for a hermetic compressor by employing a small and simple valve assembly.

The novel cylinder assembly for hermetic compressors capable of achieving the above objects includes a cylinder block having a cylinder in which a piston reciprocates, the cylinder head being connected to the cylinder block to seal the cylinder. The head is equipped with an inlet hole, and a first and second discharge chambers serve as an outlet path. The valve assembly is located between the cylinder block and the cylinder head, and that assembly controls refrigerant outflow and on flow to and from the cylinder according to the pressure difference inside and outside the cylinder.

A partition has one or more connecting holes to connect the first and second discharge chamber.

Preferably, the partition is cylindrical, the space inside is defined as the first discharge chamber, and it has a valve assembly seating surface for the valve assembly to be mounted thereon. An inlet path is positioned inside the partition, but it is not connected to the first discharge chamber. Outside the partition is defined as the second

discharge chamber.

It is preferable that the valve assembly has a valve plate having a suction port for putting the inlet hole and the cylinder in fluid communication. A discharge port for putting the cylinder and the first discharge chamber in fluid communication. A suction valve sheet has a suction valve for opening and closing the suction port; and a discharge valve sheet has a discharge valve for opening and closing the discharge port. A gasket is located between the discharge valve sheet and the valve assembly seating surface so as to block the inlet hole and the first discharge chamber. The gasket has an cut-away portion positioned to secure and limit the lift travel of the discharge valve.

In addition, it is desirable that the first discharge chamber has a stopper portion for controlling the lift of the discharge valve, which is formed at the same or lower height as that of the valve assembly seating surface.

Also preferably, a cylinder gasket is located between the cylinder head and the cylinder block in order to seal the cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and characteristics of the present invention will become more apparent from the accompanying description of a preferred embodiment of the present invention, and from reference to the accompanying drawings, in which:

FIG. 1 is a sectional view showing a conventional hermetic compressor;

FIG. 2 is an exploded perspective view showing a conventional cylinder assembly;

FIG. 3 is a sectional view showing the conventional cylinder assembly of FIG. 2 in use;

FIG. 4 is an exploded perspective view showing a cylinder assembly for a hermetic compressor provided in accordance with a preferred embodiment of the present invention;

FIG. 5 is a sectional view showing the cylinder assembly of the present invention of FIG. 4 as it may appear when it is being assembled; and

FIG. 6 and 7 are sectional views showing the cylinder assembly according to a preferred embodiment of the present invention as it may appear when in use.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Hereinafter, the following detailed description will present a cylinder assembly for a hermetic compressor according to a preferred embodiment of the invention with reference to the accompanying drawings. In describing the present invention, the like elements will be given the same reference numerals.

As shown in FIG. 4, a cylinder assembly for hermetic compressor 600 according to the present invention includes a cylinder block 610, a cylinder head 620, and a valve assembly 630. The cylinder block 610 has a cylinder 611 with a piston 320 (See FIG. 5)and a discharge muffler 612(See FIGs. 6 and 7) for reducing discharge pulse pressures of refrigerant discharged from the cylinder 611. Formed on one side of the cylinder block 610 is an outlet path 613 connecting the cylinder to the discharge muffler 612.

The cylinder head 620 is combined with the cylinder block 610 to enclose the cylinder 611 and has a partition 621 formed therein. (The partition 621 can take forms other than being cylindrical). Inside, the cylinder head 620 is divided by the partition 621 into a first 622 and a second 623 discharge chamber. Formed inside the partition 621 are an inlet path 624 through which the refrigerant flows in, and a valve assembly seating surface 625 on which the valve assembly 630 is seated. As the inlet path 624 is connected to an inlet pipe 510 that is joined with the suction muffler 500, the refrigerant of the suction muffler 500 (See FIG 5) is directed into the inlet path 624 through the inlet pipe 510.

The first discharge chamber 622 and the second discharge chamber 623 are interconnected by a connecting hole 621a formed in the partition 621 and the second discharge chamber 623 is connected to the outlet path 613 of the cylinder block 610. The more than one connecting hole 621a can be provided. The compressed refrigerant escaping from the cylinder 611 is discharged to the first discharge

chamber 622, and then to the second discharge chamber 623 through the connecting hole 621a.

In the first discharge chamber 622, a stopper portion 626 is formed with the same or lower height as the valve assembly seating surface 625. The stopper portion 626 controls the lift of the discharge valve 636 of the valve assembly 630 whereby the discharge valve 636 swiftly opens and closes a discharge port 633b.

The valve assembly 630 is cylindrical so that the valve assembly seating surface 625 precisely fits with the partition 621. The valve assembly 630 includes a gasket 631, a discharge valve 632, a valve plate 633 and a suction valve sheet 634. Inserted in the discharge chamber 622 are, in order, of the gasket 631, the discharge valve sheet 632, the valve plate 633 and the suction valve sheet 634. The valve assembly 630 is substantially the same as the partition 621 in height.

Formed in the gasket 631, the discharge valve sheet 632 and the valve plate 633 are suction ports 631a, 632a, 633a connected to the inlet path 624, and the discharge ports 633b, 634a are formed on both the valve plate 633 and the suction valve sheet 634.

The gasket 631 secures a space for a lift of the discharge valve 636 towards the first discharge chamber 622 by spacing the valve assembly seating surface 625 apart from the discharge valve sheet 632. In other words, the gasket 631 has a cut-away portion 631b which creates a lifting gap as thick as the gasket 631 between the valve assembly seating surface 625 and the discharge valve sheet 632. Therefore, the discharge valve 636 can be lifted towards the first discharge chamber 622 through the cut-away portion 631b.

The suction valve sheet 634 has the suction valve 635 formed therein in the form of a partly cut portion for selectively opening the suction port 633a. The same form also applies to the discharge valve 636 formed on the discharge valve sheet 632 in order to selectively open the discharge port 633b.

Inserted between the cylinder block 610 and the cylinder head 620 is a cylinder gasket 640 which seals between the second discharge chamber 622 and the cylinder 611 to prevent any refrigerant flow between the two. There is a path hole 640a in one part of the cylinder

gasket 640 to connect the second discharge chamber 623 and the outlet path of the cylinder block 610.

When the valve assembly 630 is assembled in the partition 621, it exactly fits into the partition 621 protrudes. Further, when the cylinder block 610 compresses the valve assembly 630 towards the cylinder head 620, the protrusion of the valve assembly 630 is pushed into the partition 621, thereby causing the valve assembly 630 and the cylinder gasket 640 to fit without void.

A preferred embodiment of the present invention will be described in greater detail with reference to FIGs. 6 and 7.

When the piston 320 moves from the upper dead center end to the lower dead center, the suction valve 635 is moved towards the cylinder 611 due to negative pressure as shown in FIG. 6. As a result, the suction port 633a of the valve plate 633 is opened and consequently, the refrigerant of the inlet pipe 510 is drawn into the cylinder 611 through the suction port 633a.

Then, the refrigerant in the cylinder 611 is compressed as the piston 320 moves from the lower dead end of its travel to the upper

dead end of its travel and accordingly, the pressure in the cylinder 611 rises. Because of the pressure, the suction valve 635 is moved as shown in dotted line of FIG. 6 to close the suction port 633a.

When the piston 320 reaches the upper dead end of its travel, the pressure in the cylinder 611 maximizes. Then, the discharge valve 636 opens to the first discharge chamber 622 of the cylinder head 620 through the cut-away portion 631b of the gasket 631 as shown in FIG. 7, opening the discharge port 633b. The lift of the discharge valve 636 is controlled when the discharge valve hits the stopper portion 626 of the discharge chamber 622. The compressed refrigerant in the cylinder 611 is discharged to the first discharge chamber 622 of the cylinder head 620 through the discharge port 633b.

After the refrigerant in the first discharge chamber 622 flows into the second discharge chamber 623, it flows to the discharge muffler 612 in the outlet path 613 of the cylinder block 610 after passing through the pass hole 640a of the cylinder gasket 640.

According to the embodiment of the present invention, the refrigerant from the cylinder 611 passes through the first and second

discharge chambers 622, 623 in the cylinder head 620, and consequently, the discharge pulsation is reduced. In addition, when the sound wave, which is generated when the suction valve 635 or the discharge valve 636 hits the valve plate 633, escapes to the discharge valve 612 through the first and second discharge chamber 622, 623, sound transmission loss occurs due to boundary interference and as a result, the sound wave is reduced. By this method, noise during operation of the compressor can be reduced.

Moreover, the refrigerant discharged from the cylinder 611 flows to the discharge muffler 612 through both the first and the second discharge chambers 622, 623, so discharge pulsation is lessened.

In addition, according to the preferred embodiment of the present invention, parts of the valve plate 633, the suction valve sheet 634, the discharge valve sheet 632 and the discharge assembly 630 are small in size and simple in design in order to be easily fit into the inside partition 621. Because of this, cylinder assembly manufacturing cost including material and assembling cost can be reduced.

Although the preferred embodiment of the present invention has

been described, it will be understood by those skilled in the art that the present invention should not be limited to the described preferred embodiment. Various changes and modifications can be made within the sprit and scope of the present invention as defined by the appended claims.